1986

Macroeconomic Adjustment Mechanisms in An Oil Based Economy: Saudi Arabia

Looney, R.E.

FINANCE & INDUSTRY

NO.7 1986

The Industrial Bank of Kuwait K.S.C.

MACROECONOMIC ADJUSTMENT MECHANISMS IN AN OIL BASED ECONOMY: SAUDI ARABIA

Robert E. Looney*

INTRODUCTION

Despite Saudi Arabia's many unique economic institutions, macroeconomic equilibrium must be established there just as is the case for any more developed (or underdeveloped for that matter) economy. The particular adjustment mechanisms that operate to eliminate disequilibrium are of special interest because alternative adjustment mechanisms may have different impacts on the subsequent path of economic growth.

The portfolio adjustment estimates developed below should provide a new perspective on the growth mechanisms of the country. Of particular interest is the manner in which adjustments in the supply and demand for money have tended to move over time.

DEMAND FOR MONEY

Money is a stock, and since expectations play a role in portfolio adjustments of individuals (more specifically wealthy holders), the speed at which actual portfolios are adjusted to desired levels should determine variations in the Kingdom's real stock of money. It is highly likely that the adjustment of money holdings of individual Saudis can be made only partially in each period because of lack of information on their part concerning developments in the econmy, inertia, and the costs involved in making adjustments(1). Furthermore (if as is likely to be the case) the desired money balances of Saudis should depend on expected (or permanent) income or other expected values of certain variables, it would take time for them to revise their expectations in light of the economic conditions they were currently experiencing(2).

It is also quite likely that individuals in Saudi Arabia, given their long run desired money balance and their money balance position in the previous period (year),

(*) Associate Professor of National Security Affairs Naval Postgraduate School.

would attempt to minimize the costs associated with their current money balance position[3]. In this case, the costs involved would consist of those required in altering portfolios and those asssociated with being out of equilibrium.

The first are commonly referred to as transactions costs and usually increase with changes in money balances[4]. The second are those of foregone yields on assets or the cost increased illiquidity and risks (depending upon whether the current money balance position exceeds or falls short of the desired position for the same period). It is usually felt that these costs increase with the discrepancy between the individual's desired and actual portfolio position. They can be depicted as:

$$(1)\ M = ML + a(MD - ML)$$

where ML = actual money supply lagged one year; MD = the amount of money currently demanded; a is assumed to have a value between one and zero and represents the speed of adjustment[5] between the actual and desired values.

The expectation lag on the other hand can be thought of as a function of the anticipated value of a certain variable (such as income) and the actual value of the previous period. It also includes a component based on the error made in previous forecasts. In other words, in each period, the expectation of Saudis is likely to be revised in proportion to the size of error committed in he expectation made during the previous period. For example in the case of income expectations, this error learning mechanism can be expressed as:[6].

$$(2)\ YE = YEL1 + b(Y - YEL1)$$

where YE = a measure of expected income; YEL1 = expected income last year; Y = actual income in the current time period; b = the average change in expectation and takes a value from zero to one.

Empirical evidence to date for other countries suggests that the speed of adjustment in expectation depends primarily on the costs associated with inaccurate information and the individual's attitude toward risks. It is argued by many writers that this lag can be ignored in developing countries. Presumably because both uncertainties and risks tend to be high in these areas[7]. However, it seems just as logical to argue that if in fact the majority of entrepreneurs and households in those countries have higher uncertainties and are greater risk averters, there could be a ralatively longer expectation lag (i.e. smaller b), particularly as the risk averters act in a conservative manner in adjusting their portfolios.

Clearly the existence of either lag and their lengths in Saudi Arabia should be treated as an empirical matter. To this end, a long run demand for money func-

tion was specified as directly related to expected income (YE) and inversely related to the expected degree of credit restraint (CR) and the expected rate of inflation (INF) or

$$M = d(YE) - c(CRE) - d(INF).$$

Here credit restraint was defined as the ratio of private credit to non-oil income[8]. It has a negative sign because it is likely that when commercial bank credit is tightened, individuals conserve on their money balances, whereas in periods of easy credit, they may keep excess balances (because of their low opportunity costs).

Inflation was defined as the rate of inflation in the previous year minus the rate of inflation in the year prior to that.[9].

If we assume that money holders have identical expectations with respect to income, inflation and the degree of credit restraint then the demand for money can be expressed[10] as:

$$M = [(1-a) + (1-b)ML - (1-a)(1-b)ML2 + abc(CR) - abd(INF) + abe(Y)]$$

If only the demand adjustment lag is operative, then the actual value of a and b must be $0<a<1$ and $b = 1$. In this case the above equation becomes:

$$M = (1-a)ML + abY - ab(CR) - ab(INF) + aeY$$

If only the expectation lag exists, then b must be greater then 0 but less than 1 $(0<b<1)$ and $a = 1$.

In this case the equation becomes:

$$M = (1-a) + (1-b)ML - (1-a)(1-b)ML2 + beY - bc(CR) - bd(INF)$$

It is clear that if neither lag exists, then the equation reduces to

$$M = eY - c(CR) - d(INF)$$

The magnitude and statistical significance of the coefficient of the lagged money is a demand for money function, and can therefore be used to evaluate the existence and length of either the expectation lag or the demand adjustment lag.

When money lagged for one and two periods are both introduced in the function, the coefficients can be used to measure both lags.

The results (equation 1 - 3) for various specifications of the demand for money function indicate the possibility of the existence of both lags; i.e.:

(1) M = 0.826 (ML) - 0.215(ML2) + 0.373 (GDPN) - 0.54 (CR) - 0.034 (INF)
(3.27) (-1.00) (8.4) (-2.90) (-1.67)

b = 0.174; a = 0.260; r^2 = 0.9989; DW = 2.663

(2) M = 0.829 (ML) - 0.483 (ML2) + 0.628 (GDPN) - 0.038 (CR) - 0.028 (INF)
(2.63) (-2.03) (6.67) (-1.71) (-1.17)

b = 0.172; a = 0.583; r^2 = 0.9984; DW = 2.533

(3) M = 0.369 (ML) - 0.245 (ML2) + 0.860 (DAN) - 0.043 (CCR) - 0.030 (INF)
(2.07) (-1.92) (14.31) (-3.88) (2.86)

b = 0.631; a = 0.388; r^2 = 0.9996; DW = 2.302

where CR = private credit/nominal non-oil income; INF = rate of inflation, (t) -rate of infaltion (L). All coefficients are in standardized (Beta) values.

The results give interesting insights into Saudi portfolio behaviour. Apparently, while it is costly for individuals in the Kingdom to be out of equilibrium, it is also costly for them to make adjustments to restore equilibrium. Apparently, deficiencies in their money holdings imply excessive holdings of other assets. The costs associated with restoration of equilibrium must, therefore, depend (among other things) on liquidity and the ease of convertibility of other assets.

We know that because of Islamic codes and the lack of government debt, there are few financial assets available. Most assets other than cash would be real (physical such as land, gold, etc.). The deficient financial structure, therefore, may explain the somewhat slow portfolio adjustment process observed during this period.

To summarize, if the speed of adjustment depends on adjustment costs, it will take longer for wealth holders in Saudi Arabia than in most countries to adjust their money holdings (i.e. a smaller value of a) because nearly all other components in their portfolio are dominated by real assets. Clearly, it takes an individual more time to make a land or a house transfer than to make a switch between a checking account and a savings account.

Our results are, therefore, contrary to the assertion made by many writers that monetary lags are negligible in countries where there is a lack and variety of financial assets. The Saudi tradition and willingness to substitute real assets for money is apparently a major reason for that country's deviation from the normal developing country pattern.

MONEY SUPPLY

The most interesting monetary pattern is the acceleration in the growth rate of the money supply (M1) after 1971. While the annual growth rate was 10.1 percent over the period 1960-1971, it rose sharply to about 43 percent in 1972, 40 percent in 1973, and 41 percent in 1974, reaching a peak of nearly 90 percent in 1975. Over the 1972-79 period, the average annual growth rate of M1 was 46.5 percent.[11].

Equally interesting is the observation that the monetary stock series closely resembles that of high powered money--the monetary base (MB):

$$(4)\ M1 = \underset{(70.93)}{1.17MB} + \underset{(1.50)}{0.36}$$

$$r^2 = 0.9972;\ F = 5030.88;\ DW = 1.7036$$

The relationship between the money stock and the monetary base is an important one. In the next chapter projections of the growth in the money supply are made from estimates of the likely growth of the monetary base.

The most important component of the supply of money base in Saudi Arabia is clearly the level of foreign reserves. During the 1960-77 period, the minimum contribution of foreign reserves to the monetary base was 125.76 (1960). While in 1974 this source rose to 1,178.50 percent. Until 1971 there is a rather stable pattern with foreign assets contributing on the average 232.56 percent to the monetary base. This stability was apparently disturbed by a number of factors including the oil price increases in 1973-74.

The public sector component of the monetary base consists of the net claims of SAMA over government. Since the government did not borrow from SAMA during the 1960-79 period[12], this figure was negative, indicating that government deposits exceeded the stock of government liabilities with SAMA. In the accounting sense, therefore, SAMA became an increasing net debtor to the government.

This process began with the introduction of the government's stabilization program in June 1958, the liquidation of the debt received priority. Although complete data for that period are not available, it is clear that through fiscal 1961 the budgeted increase in expenditures was held well below the anticipated increase in revenues. In addition, by early 1960 the government had repaid virtually all of its debt to SAMA; by the end of 1961 practically all the internal debt had been liquidated and a beginning had been made in repayment of the external debt[13].

As noted oil revenues affect both the domestic and external components of the money base.[14]. Any changes in oil revenue will change government revenues, thereby changing the net position of the government with SAMA. Because oil revenues are denominated in dollars, a change in this figure will also produce a similar change in the foreign reserves of the bank.

The relationship between oil revenues, government deposits, and the monetary base distinguishes the Saudi Arabian economy from most developing countries. In the usual case, the private sector is the main or sole recipient of export earnings. Given relatively fixed exchange rates, these earnings increase the foreign assets of the central bank. They will also have a direct and equal expansionary effect on the supply of bank reserves (and hence on the supply of money).

Because the government is the main recipient of export earnings in Saudi Arabia, there is not a direct link between foreign exchange earnings, changes in foreign reserves of the central bank, and changes in money base. The remifications of the Kingdom's unique monetary situation are seen most directly in the manner in which the country's money supply is determined, and are best understood by examining the consolidated balance sheet of government and SAMA.

From the liability side of this consolidated balance sheet, one can obtain a relationship describing the use of the monetary base (MB)[15]:

(a) MB = SCOB + LRD + ERB

where SCOB = currency in the hands of the public; LRB = legal reserves of the commercial banks, and ERB represents the excess reserves of these banks.

Correspondingly, from the asset side of the consolidated balance sheet the sources of the monetary base can be identified as:

(b) MB = SFA + GNAC + BAC + EAC

where SFA = foreign assets held by SAMA less the loans and credits received from abroad; GNAC = claims on the government less the government deposits with SAMA; BAC = SAMA's advance and rediscounts to the commercial banks; EAC = other items on the asset side less the import registration deposits of the private sector and contingent liabilities.

The items of the balance sheet have been rearranged to reflect the separate components of the monetary base. In this regard, it is important to distinguish between the external sources (determined by the conditions in the balance of payments) and

the internal sources (which depend on the government's budgetary position and the commercial bank's borrowing from SAMA.

External sources of the monetary base consists mainly of SAMA's net foreign asset holdings (SFA) which in turn depend essentially on the country's balance of payments position over time and is reflective of transactions in both the current and capital accounts.

Under the system of fixed (or pegged) exchange rates, the balance of payments acts as a constraint on the country's supply of monetary base. The exact way in which the situation in the balance of payments affects the changes in SAMA's foreign assets is:

(c) Δ SFA = FCOB + Δ (FLB - FAB) + Δ (FLG - FAG)

where FOCB denotes the current account balance, (FLB - FAB) represents the net foreign liability of the banks, (FLG - FAB) is equal to the net foreign government debt ($\Delta$is the yearly difference).

In deriving these relationships, it is implicitly assumed that the non-bank public in Saudi Arabia does not hold foreign assets or incur foreign liabilities. It is also assumed that private corporations do not issue securities or bonds to foreigners. These assumptions are indeed justifiable because of the very initial stages of capital market development in the Kingdom.

The balance of payments on current (FCOB) is equal to the total exports of goods and services minus imports of goods and services. In Saudi Arabia where oil is the major export and the dominant source of Gross Domestic Product, the level of imports can be safely assumed to be dependent on their level, or:

(d) FCOB = aGORFS + b

where GORFS denotes oil revenues and a and b are constant parameters.

The internal components of the monetary base consist of the government debt (when rarely incurred) to SAMA, GNAC, and the banks borrowing form SAMA. Because the bond market is insignificant, the government's rare deficits were financed mainly through increases in the government debt with SAMA (GNAC). In theory the government could also have placed securities either abroad (FLG - FAG) or with the banks (BLG - BAG); i.e.,

(e) GDFICIT = Δ GNAC + Δ (FLG - FAB) + Δ (BLG - BAG)

where GDFICIT denotes the government deficit.

The government deficit itself is defined here as government expenditure, GENAN, minus government revenue, GRFS, (being composed of oil revenue, GORFS, and non-oil revenue, GNORFS:

(f) GDFICIT = GENAN - GORFS - GNORFS

The manner in which oil revenue affects the monetary base is Saudi Arabia is seen best through an examination of the adjusted monetary base (BA) defined as:

(g) BA = B - (FLB - FAB) - BAC - EAC

The advantage of analyzing BA as a means of detemining the money supply process in Saudi Arabia is that it is comprised only of items not influenced by the commercial banks.

Substituting for B from equation (b) yields:

(h) BA = SFA + GNAC - (FLB - FAB)

Taking the differences and substituting for SFA and GNAC from equations (e) and (c) and utilizing equations (d) and (f), we obtain an expression which defines the change in the adjusted monetary base as a function of oil revenue and government expenditure, or:

(i) ΔBA = (a-l-x)GORFA + (1-x)(GENAN-GNORFS) + (b-y)

It follows from equation (h) that the way that the oil revenue affects the change in the adjusted monetary base depends on two parameters a and x. For oil revenues to have a positive impact on the monetary base, all that is required is for a Δ(1-x).

What might seem as a contradiction in terms would be the reverse situation where aΔ(1-x) would result in oil revenues having a negative influence on the money base.

Estimation yields:

(5) ΔBA = -1.49 - 0.06986GORFS + 0.48(GENAN - GNDRFS)
(11.65) (0.89)
r^2 = 0.95

implying a value of 0.411 for x and 0.520 for z.

Further, since (1-z) = 0.48, oil revenues in fact had a negative impact on the change in the money base.

The values for x and z are realistic since from the equations

$$COB = (x)\ GORFS + b$$

$$(6)\ COB = -2.07 + 0.66GORFS \qquad r^2 = 0.91$$
$$(11.79)$$

and

$$\Delta GENAN = (z)\ GDFICIT + a$$

$$(7)\ \Delta GENAN = 0.58 + 0.76GDFICIT \qquad r^2 = 0.80$$
$$(7.72)$$

Again, it seems somewhat paradoxical to argue that incresed oil revenues would actually reduce the money base. Looked at in terms of the relationships individually depicted by x and z, however, the result is plausible; z can be interpreted as the proportion of the government surplus (deficit) which is deposited either with SAMA or the commercial banking system.

Due to the attractiveness of foreign investments, we would expect z to be somewhat less than one. On the other hand, z can be interpreted as the marginal impact of oil revenue on the current account balance of payments. Given the significance of oil revenues in the country's national income accounts and the Kingdom's high marginal propensity to import, x should be relatively small. Other formulations (equations 8 -15) confirm these conclusions.

$$(8)\ \Delta BA = 1.60\Delta GENAN - 0.21\Delta GORFS - 0.08 \qquad r^2 = 0.9515;\ F = 117.60$$
$$(15.05) \quad (-4.12) \quad (-0.09)$$

$$(9)\ \Delta MB = 0.39\Delta GENAN + 0.05\Delta GORFS - 0.09 \qquad r^2 = 0.9340;\ F = 84.88$$
$$(10.34) \quad (2.44) \quad (-6.28)$$

$$(10)\ \Delta BA = 1.40\Delta GENAN - 0.92 \qquad r^2 = 0.8827;\ F = 97.82$$
$$(9.89) \quad (-0.74)$$

$$(11)\ \Delta MB = 0.43\Delta GENAN + 0.09 \qquad r^2 = 0.9011;\ F = 118.44$$
$$(10.88) \quad (0.26)$$

$$(12)\ BA = 1.22GENAN - 2.73 \qquad r^2 = 0.9834;\ F = 770.49$$
$$(27.76) \quad (-2.72)$$

$$(13)\ \Delta BA = 1.52\Delta GENAN - 0.17\Delta OGDPN + 0.07$$
$$(11.39) \quad (-2.45) \quad (0.05)$$
$$r^2 = 0.9233;\ F = 66.23$$

(14) MB = 0.15GENAN + 0.44GENANL - 1.33
(2.61) (5.81) (-4.24)
r^2 = 0.9973; F = 2591.44

(15) ΔMB = 0.19ΔGENAN + 0.33ΔGENANL + 0.21
(4.73) (7.30) (0.85)
r^2 = 0.9611; F = 173.05

Some further justification for this finding might be sought on the ground of interpreting the negative influence of oil revenue on the change in monetary base as an indication of the action of monetary authorities in sterilizing the impact of foreign reserves in monetary base.

To illustrate this point of view further, it is of interest to analyze more precisely the behavior of the Saudi Arabian monetary authorities in their attempt to offset the impact of foreign reserves on monetary base. An estimate of the degree to which the monetary authorities adjust the domestic component of monetary base to changes in the external component can be obtained from regressing the change in monetary base (MB) and adjusted monetary base (BA) an SAMA's foreign assets (SFA) on the change in SAMA's foreign assets (ΔSFA).

(16) Δ (MB - SFA) = -0.85ΔSFA + 0.40
(-51.97) (0.26)
r^2 = 0.9948; F 2700.52

(17) Δ (BA - SFA) = -0.74ΔSFA + 2.52
(-6.46) (0.87)
r^2 = 0.7486; F = 41.68

According to these estimates (equations 16 & 17), the Saudi Arabian monetary authorities on the average adjust the domestic component of the monetary base by 85 rials out of each 100 rial change in foreign reserves, and the domestic component of the adjusted monetary base by about 74 rials out of each 100 rial change in foreign reserves. These results clearly indicate that the Saudi Arabian monetary authorities have been relatively successful in sterilizing movements in foreign reserves. This conclusion is certainly open to question.

It should be noted that part of the negative impact of the variation in foreign reserve on domestic component of monetary base can be attributed to the fact that the oil revenue, by nature, affects both the domestic and external components of the monetary base; i.e. any increase in the oil revenue increases the foreign reserves held by SAMA while at the same time, given the level of government expenditure, decreases the claims of the central bank over the government.

This automatic sterilization process is of utmost importance in understanding the nature and the mechanism of monetary policy in Saudi Arabia. However, it cannot be denied that the conscious actions of the central bank mainly through the exercise of its control over the commercial banks, such as changes in legal reserves requirements, changes in advance and discounts to the banks and so on have been quite effective in offsetting the movements of foreign reserves on the domestic component of monetary base.

The higher estimate (0-85) for SFA obtained when regressed on the monetary base (as compared with 0.74 when regressed on the adjusted base) is partial evidence of the effectiveness of SAMA in this regard. This follows from the fact that the amount of banks' borrowing from SAMA is included in the definitions of the monetary base (MB), while excluded from the adjusted monetary base (BA).

However, granting the imperfection of instruments of monetary policy, there may still be a considerable degree of sterilization. Ultimately, the question is an empirical one, and the evidence presented seems to tentatively indicate that the Saudi monetary authorities have been somewhat successful in neutralizing balance of payments fluctuations.

CONCLUSIONS

A second important conclusion emerging from the analysis was the significant contribution of the monetary base to the growth of money stock. A complete understanding of the process of money supply determination in Saudi Arabia thus ultimately requires an analysis of the factors determining the growth rate of monetary base.

Most of the literature on the interaction between domestic and international components of the money supply deals with developed countries and whether, given their high degree of capital market integration, central banks can exercise effective control over the money supply. Advocates of the monetary approach to the balance of payments contend that central bank control is limited by the fact the domestic component of the money supply will tend to be offset by counterbalancing foreign exchange flows.

While the capital markets in Saudi Arabia are certainly not as closely integrated with the rest of the world as are those of many of the advanced countries, the degree of control over the domestic component of the monetary base and thus SAMA's ability to sterilize reserve flows has been questioned on the grounds that its instruments of monetary policy available are very limited in their effectiveness.

NOTES

(1) Thomas Mayer, "The Structure of Monetarism (I)," in Thomas Mayer, **The Structure of Monetarism** (New York: Norton, 1978), p. 2.

(2) Cf. the general framework developed in Thomas Sargent and Neil Wallace, "Rational Expectations and the Theory of Economic Policy, "**Journal of Monetary Economics** (April 1976), pp. 169-185.

(3) E. Feige, "Expectations and Adjustments in the Monetary Sector," **American Economic Review** (May 1967).

(4) W. J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," **Quarterly Journal of Economics** (November 1952).

(5) Feige, **op. cit.**

(6) Chorng-huey Wong, "Demand for Money in Developing Countries," **Journal of Monetary Economics** (January 1977), p. 72.

(7) J. O. Adekunle, "The Demand for Money: Evidence from Developed and Less Developed Economies," International Monetary Fund, **Staff Papers** (November 1971).

(8) For alternative means, see Wong, **op. cit.**, p. 65.

(9) Following A. Harberger in "The Dynamics of Inflation in Chile," **Measurements in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld** (Standford: Standford University Press, 1963), pp. 215-296.

(10) Wong, **op. cit.**, p. 73.

(11) All data on the money supply is taken from International Monetary Fund, **International Financial Statistics**, various issues.

(12) Said Hitti and George Abed, "The Economy and Finances of Saudi Arabia," International Monetary Fund, **Staff Papers** (July 1974), p. 287.

(13) **Ibid.**

(14) For an excellent elaboration Cf. David Morgan, "Fiscal Policy in Oil Exporting Countries, 1972-78," International Monetary Fund, **Staff Papers** (March 1979), pp. 55-86.

(15) For an application of this approach to another oil exporting country, see M. Pailami, "The Determination and Control of Money Supply in an Oil Exporting Country: The Iranian Experience," MIT Energy Laboratory, **Working Paper No. MIT-EL 78-027WP** (Revised February 1979).